PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 667754C	FOR FURTHER ACTION	See Form PCT/IPEA/416
International application No. PCT/AU2004/000339	International filing date *(day/month/year)* 19 March 2004	Priority date *(day/month/year)* 7 April 2003
International Patent Classification (IPC) or national classification and IPC **Int. Cl.** [7] C03C 15/00, 21/00, 23/00, H01L 31/0236, 31/18		
Applicant UNISEARCH LIMITED et al		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. [X] *(sent to the applicant and to the International Bureau)* a total of 2 sheets, as follows:
      - [ ] sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      - [ ] sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.

   b. [ ] *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or table related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).
4. This report contains indications relating to the following items:
   - [X] Box No. I Basis of the report
   - [ ] Box No. II Priority
   - [ ] Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - [X] Box No. IV Lack of unity of invention
   - [X] Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - [ ] Box No. VI Certain documents cited
   - [ ] Box No. VII Certain defects in the international application
   - [ ] Box No. VIII Certain observations on the international application

Date of submission of the demand	Date of completion of the report
5 November 2004	1 March 2005
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer **JAMES DZIEDZIC** Telephone No. (02) 6283 2495

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/AU2004/000339

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:

☐ international search (under Rules 12.3 and 23.1 (b))

☐ publication of the international application (under Rule 12.4)

☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements** of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

☐ the international application as originally filed/furnished

☒ the description:

pages **1, 3-7** as originally filed/furnished
pages* **2** received by this Authority on **5 November 2004** with the letter of **5 November 2004**
pages* received by this Authority on with the letter of

☒ the claims:

pages **9-10** as originally filed/furnished
pages* as amended (together with any statement) under Article 19
pages* **8** received by this Authority on **5 November 2004** with the letter of **5 November 2004**
pages* received by this Authority on with the letter of

☒ the drawings:

pages **1/2 – 2/2** as originally filed/furnished
pages* received by this Authority on with the letter of
pages* received by this Authority on with the letter of

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages
☐ the claims, Nos.
☐ the drawings, sheets/figs
☐ the sequence listing (*specify*):
☐ any table(s) related to the sequence listing (*specify*):

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

☐ the description, pages
☐ the claims, Nos.
☐ the drawings, sheets/figs
☐ the sequence listing (*specify*):
☐ any table(s) related to the sequence listing (*specify*):

* *If item 4 applies, some or all of those sheets may be marked "superseded."*

Box No. IV Lack of unity of invention

1. ☐ In response to the invitation to restrict or pay additional fees the applicant has:

   ☐ restricted the claims.

   ☐ paid additional fees.

   ☐ paid additional fees under protest.

   ☐ neither restricted nor paid additional fees.

2. ☒ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is:

   ☐ complied with.

   ☒ not complied with for the following reasons:

   The international application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single inventive concept. In coming to this conclusion the International Examining Authority has found that there are two inventions:

   1) Claim 1 directed to a method of texturing glass by coating it with a material film, stimulating a reaction of that film so it interacts with the glass, forming reaction products on it, then removing the film and reaction products to form a textured surface. It is considered that the combination of producing a material film on the glass, treating it to react with the glass and form reaction products, then removing the film and the reaction to form the textured glass, together comprise a first "special technical feature." Claims 2-20 dependent on claim 1 also contain the same special technical feature.

   2) Claim 21 directed to a photovoltaic device incorporating a glass pane having a textured surface and a semiconductor film on that surface, characterised by its absorption efficiency in a given range of photon wavelength. The provision of a semiconducting layer on the textured glass having this absorption efficiency characteristic comprises a second "special technical feature." The method by which the textured glass surface is made is not specified in claim 21, which is therefore not directly related to the method of claim 1.

   Since the above-mentioned groups of claims do not share either of the technical features identified, no technical relationship within the meaning of PCT Rule 13.2 can be seen between the different inventions. Therefore the claims do not satisfy the requirement of unity of invention.

   The novelty and inventive step of claims 22-25 have only been considered insofar as limited to the texturing step of the preceding claims.

4. Consequently, this report has been established in respect of the following parts of the international application:

   ☐ all parts.

   ☒ the parts relating to claims Nos. **1-20, 22-25**

Box No. V **Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N).	Claims **1-20, 22-25**	**YES**
	Claims	**NO**
Inventive step (IS)	Claims **1-20, 22-25**	**YES**
	Claims	**NO**
Industrial applicability (IA)	Claims **1-20, 22-25**	**YES**
	Claims	**NO**

2. Citations and explanations (Rule 70.7)

NOVELTY & INVENTIVE STEP

WO 2000/028602 A (PACIFIC SOLAR PTY LIMITED) 18 May 2000 discloses a method of roughening the substrate for a solar cell in which a thin film (0.1-0.5mm) of etching paste including HF and BaS04 is applied to the glass. The paste and reaction products with the glass are removed after reaction (which is not specifically "stimulated") is complete. This document is cited as being indicative of the current state of the art.

US 4885053 A (BOGENSCHUTZ et. al.) 5 December 1989 discloses a method for etching a ceramic using a layer of precursor of an etching agent that is activated/stimulated to etch the surface of the ceramic, after which the remaining film and reaction products are removed.

US 5376197 A (SCHAUPERT) 27 December 1994 discloses a system wherein a solid film on a glass, glass ceramic or ceramic substrate upon stimulation (ie heating) is shown to react with the substrate to roughen it. The application concerns a method of removing the film and the damaged glass

A very similar argument to the above applies to the related application DE 4318178 A (SCHOTT GLASWERKE) 8 December 1994.

US 2003/0213770 A (YAMADA et. al.) 20 November 2003 discloses a process for etching glass in which a laser beam vaporises a thin film of metal on a glass surface, the glass also being etched.

US 5399185 A (BERTHOLD et. al.) 21 March 1995, is a typical example of the situation where a film of material on a glass substrate is stimulated so that a reaction takes place between the film and the substrate - this case, though, to form a stronger bond between the two layers rather than to etch the substrate

US 4042449 A (HUNT et. al.) 16 August 1977 illustrates a somewhat similar system where reaction products are formed between a glassy substrate and a metal film, however in this case the reaction products remain on the substrate as raised projections rather than being removed to form depressions as per the current application.

As none of the citations specifically disclose texturing of glass surfaces as per the amended claim the invention is considered novel and inventive.

INDUSTRIAL APPLICABILITY

The Industrial Applicability of claims 1-20, 22-25 is not in question.

difficult to scale up the sol-gel method to very large dimensions (~ 1 m^2) as required for photovoltaic panels.

A need, therefore, exists to provide an alternative method of texturing a glass surface which addresses one or more of these disadvantages.

Disclosure of the invention

In accordance with a first aspect of the present invention there is provided a method of texturing a glass surface, the method comprising the steps of coating the glass surface with a solid material film, stimulating a reaction at the interface between the glass and the material film resulting in the formation of reaction products at the interface, and removing the material film and the reaction products from the glass surface.

In one embodiment, the step of stimulating the reaction at the interface comprises a thermal annealing process. The thermal annealing process may comprise a sequence of annealing steps at different temperatures. The thermal annealing process may be conducted in a controlled ambient atmosphere.

The material film may comprise a single material or compound material.

The glass surface may initially be substantially flat.

The material film in one embodiment comprises aluminium. The reaction products may comprise aluminium oxide.

The step of removing the material film and the reaction products may comprise one or more etching steps. The etching steps may comprise a chemical etch.

The glass may comprise quartz, float glass, or non-float glass.

In accordance with a second aspect of the present invention there is provided a method of manufacturing a photovoltaic device, the method comprises the steps of texturing a glass surface utilising the method as defined in the first aspect, and depositing a semiconductor film on the textured glass surface, whereby the glass-facing surface of the semiconductor film exhibits substantially the same degree of texture as the glass surface.

Claims:

1. A method of texturing a glass surface, the method comprising the steps of:

- coating the glass surface with a solid material film,
- stimulating a reaction at the interface between the glass and the material film resulting in the formation of reaction products at the interface, and
- removing the material film and the reaction products from the glass surface.

2. The method as claimed in claim 1, wherein the step of stimulating the reaction at the interface comprises a thermal annealing process.

3. The method as claimed in claim 2, wherein the thermal annealing process comprises a sequence of annealing steps at different temperatures.

4. The method as claimed in claims 1 or 2, wherein the thermal annealing process is conducted in a controlled ambient atmosphere.

5. The method as claimed in any one of the preceding claims, wherein the material film comprises a single material or compound material.

6. The method as claimed in any one of the preceding claims, wherein the glass surface is initially substantially flat.

7. The method as claimed in any one of the preceding claims, wherein the material film comprises aluminium.

8. The method as claimed in claim 7, wherein the reaction products comprise aluminium oxide and/or silicon.